HumRRO
HUMAN RESOURCES RESEARCH ORGANIZATION

Third-Party Checking of 2014 Scaling and Equating for the Kentucky Performance Rating for Educational Progress (K-PREP) Tests

Final Report

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Executive Summary

Pearson and HumRRO independently calibrated, scaled and equated the 2014 Kentucky Performance Rating for Educational Progress (K-PREP) assessments and produced the raw-score-to-theta-score tables to be applied to students' test results. Results calculated by HumRRO were identical to those calculated by Pearson (M. Johnson, email communication, July 15, 2014). Given that HumRRO's results were identical to those of Pearson, we are assured that Pearson did not commit processing errors.

Third-Party Checking of 2014 Scaling and Equating for the Kentucky Performance Rating for Educational Progress (K-PREP) Tests

Introduction

In 2012, Kentucky transitioned from the Kentucky Core Content Test (KCCT) to the K-PREP system for spring testing. This transition represented a significant departure from the prior assessment system. The 3 parameter logistic IRT model was replaced with a Rasch model, a new item-type (i.e., short-constructed-response) was added to the assessments, a new scale-score reporting system was developed for sub-scores, and new cut scores were identified for the reading and mathematics assessments. The transition was also accompanied by a new primary testing contractor, Pearson. As a result, HumRRO's third-party checking process underwent significant changes to accommodate the transition[1].

Equating was added to the process in 2013 to permit comparison of the results across test years. The 2014 tests were equated to the 2013 tests using linking items. In this manner, comparable scores were produced for the 2014 K-PREP.

This report describes how student test responses for the 2014 K-PREP assessments were used to create scale scores and place students in Novice, Apprentice, Proficient or Advanced (NAPD) performance categories. The complex analyses to accomplish these tasks were conducted independently, but cooperatively, by both HumRRO and Pearson staff members. Several interim checks were conducted during the analyses and any discrepancies between the two companies was investigated and ultimately resolved. This process was conducted transparently among Pearson, HumRRO, KDE, and Kentucky's psychometric consultant (Dr. Bill Auty of EdMeasure) via frequent email communications and daily conference calls. The process was guided by a specifications document created by Pearson[2] and regularly updated based on decisions before and during calibration. This documentation is vital for ensuring consistency of processing across years and serves as a guiding document for subsequent years.

Sample Identification and File Construction

Kentucky selects most of its student population for use in the calibration sample for scaling and equating. However, some students are purposefully exempted. KDE established a set of invalidation codes for excluding students in the calibration file. Kentucky's exemption rules only apply to students who receive accommodations (e.g., Braille forms, audio, large print, etc.) and students with duplicate records (the same identification number and name). The accommodated students receive scores, but are simply omitted from the calibration sample. Pearson and HumRRO verified n-counts after this step.

The next step was to format all of the grade/subject files to be read into the Winsteps IRT program and create Winsteps control files to read the student responses and estimate parameters. A sample control file is provided in Appendix A. HumRRO created specialized SAS programs to generate all input and control files automatically. The item documentation file was used to specify item types, location, keys, item use (field test vs. operational items), and other important information. HumRRO and Pearson did not share programming or methodology for

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[1] For additional details on how the assessment system and third-party checking procedures changed, see Bynum and Thacker (2013).

[2] K-PREP Sp14 CES Specs_KDE v1.0.doc.

creating the input and control files. Both companies did use the same student data files (containing all student responses). HumRRO followed the guidance provided by Pearson (with input from KDE) regarding the treatment of blank responses, condition codes, etc. in creating the input data files.

Calibration and Scaling Procedures

Once input and control files were prepared, Winsteps was used to calibrate items. Multiple-choice items were fit to the Rasch measurement model and constructed-response items (short constructed response and extended response items) were fit to the Partial Credit Model (PCM). Both types of items were simultaneously calibrated in Winsteps and item difficulty parameters (logits) were produced. "Step parameters" were also produced for constructed response items. Step parameters tell us how the various points possible on the item relate to the item's overall difficulty and are important for generating scoring tables. These parameters are produced on the theta scale (a commonly used scale with a mean of 0 and a standard deviation of 1). Appendix B contains an example of item parameters for one grade subject (logits and step parameters).

Equating Procedures

Two types of equating occurred for the K-PREP: (a) forms equating within a given test administration year and (b) equating across test administration years using common anchor items. The first of these, forms equating, is accomplished by calibrating all of the items for a given grade/subject together. By calibrating all of the items together (i.e., across all forms), this effectively equates the various forms for a given grade/subject such that test scores on form 2 and form 3, for example, are interchangeable in terms of difficulty. Kentucky uses common forms for all operational items (those that contribute to student scores), but the forms differ on field-test items. Field-test items are used to build future forms.

In addition to the need to equate the forms of a test within a given year, there is also the need for the current year's scores to be comparable to scores from prior years. For 2014, we equated to the prior scale for Reading, Math, Science and Social Studies. Kentucky uses a common-item anchor design to equate K-PREP scores across years. The anchor items are "internal" in the sense that they are dispersed across forms rather than externally located in a separate anchor item form. For 2014, we used items repeated from the 2012 and 2013 assessments. K-PREP also has embedded SAT-10 items, some of which were included as anchor items. Both multiple-choice and open-response items are designated as anchor items for equating for all grades and subjects.

Equating across test administrations involved three steps. First, an initial calibration was run with all items freely estimated. Second, an item stability check was performed on the linking item parameters using the Robust Z statistical procedure (Huynh, 2000; Huynh & Rawls, 2009; Huynh & Meyer, 2010). The procedure compared the item difficulty estimates of the 2012-13 and 2014 linking items (b-parameter estimates for multiple-choice items and step parameters for open-ended items) to identify items which should be dropped. See Appendix C for an outline of the steps in the procedure and the criteria for exclusion. Any items flagged for removal were discussed with Pearson at this stage. Lastly, a final calibration was run using the 2012-13 item parameter estimates as anchor values for the linking items, thereby placing the 2014 tests onto the same measurement scale as the 2012-13 tests. The multiple-choice items were anchored to the 2012-13 item Rasch difficulty parameter estimates and the open-ended response items were anchored to both the 2012-13 item difficulty estimates and the category threshold

measures that were computed for each step. These final (equated) item parameters were compared to Pearson's parameter estimates.

For math grades 4, 5, and 6, the overall model criteria for removing linking items (see Appendix C for specific criteria) was within acceptable ranges, suggesting no need to remove any items from equating. However, upon further examination we noticed a trend in the results where several open-response threshold measures had high Robust Z values ($|Z| > 2$). As a precaution, we ran the equating analysis removing these open response items from the equating set and investigate the impact on scores. For grades 4 and 5, there was no differences in the percent of students in each performance category. For grade 6, there were small differences in the percent of students that were categorized as Novice and Apprentice. The differences were small enough that the overall impact was negligible. Therefore, all open-response items were retained in the linking set.

Raw-score-to-Scale-Score Procedures

Once the final item parameters were estimated, they were used to create scoring tables. At this stage, the scoring tables produced by the final item calibration run in Winsteps are still on the theta metric. Each potential "number of total score points (multiple-choice items correct plus total points on constructed response items)" is associated with a theta estimate. This "person-level" theta would be their score on the theta scale. Output files were verified to match between HumRRO and Pearson at this stage.

Once theta scoring tables were obtained, they were linearly transformed to a reporting scale of 100-300 for all grade subjects. Performance levels (Novice, Apprentice, Proficient, and Distinguished) were also assigned to each score. Cut scores for the performance levels were determined following a standard setting workshop conducted in the summer of 2012 (see Pearson, 2013). The results of that workshop included cut scores on the theta metric that can be used to assign NAPD categories to students. Scale score cuts were used, as opposed to theta cuts, to assign performance levels to students' scale scores. Using these cuts allowed the scale scores associated with each performance level to be fixed across test administrations. HumRRO verified the raw-score-to-scale-score tables and the associated performance levels.

In addition to overall scores, Kentucky also reports cluster scores (subscores based on subsets of items within each test). The generation of cluster scores uses the previously estimated item parameters and is accomplished by generating scoring tables in Winsteps on the theta metric, based on the specific items identified for each scoring cluster. These theta scores are then transformed in exactly the same manner as the full test scores.

Finally, for grade 6 Reading and grade 4 Math there were items on the non-braille form that were unsuitable for braille examinees. Separate score tables for the braille form were produced and verified for these two tests. Separate theta estimates were calibrated for Braille, using the equating solution of the non-braille test, but omitting the unsuitable items. Using the common items, new score tables were constructed and compared to Pearson's estimations.

Verification of 2014 Scoring Tables

After the final scoring tables were constructed, the scoring tables were applied to the 2014 student data. HumRRO checks the 2014 scored student data to verify that the scoring tables are being appropriately applied to the data and to check the distribution of students falling into each performance level. In addition to Reading, Math, Science, and Social Studies, the

performance level distribution was also verified for writing. HumRRO matched Pearson on the number and percent of students assigned to each performance level by subject and grade.

Documentation

As HumRRO and Pearson completed each step of the process described above, Winsteps control, item parameter, score, and output files were shared to check for inconsistencies. Winsteps output contained the number of cases in the calibration sample, item-level information (e.g., p-values, parameters), and the theta scoring tables. A sample of the output files are appended to this document. They include:

1. Winsteps Control Files (Appendix A). These files contain the item parameter estimation specifications and important information for reading the student score files. It also specifies the output file names. The appendix includes an example control file for the initial item parameter estimation, equated item parameter estimation, and estimation of the cluster scores.

2. Winstep Item Parameter Files (Appendix B). These files contain the item parameters for the operational items. Each multiple-choice item has one parameter, a logit difficulty (named Measure in the Wintsep files). Each constructed-response item has an overall difficulty parameter and a number of step parameters indicating how the points for the item are distributed along the theta scale. The file included in the appendix is an example of a final item parameter file. Initial item parameter files are in similar formats.

3. Winsteps Anchor File (Appendix D). The file includes the 2012-13 item parameter values for each anchor item. The file is read by Winsteps and used to fix the anchor item parameter values.

4. Winsteps Score File (Appendix E). The file contains the raw score to theta estimation and includes the distribution of student scores.

5. Comparison of Files Output (Appendix F). This is a SAS output file from HumRRO's comparison program that checks scoring table results against Pearson's results. The files match if all comparison values are 0.

Conclusion

Pearson and HumRRO independently calculated the scaled/equated raw-score-to-scale-score tables for the 2014 K-PREP assessments. No differences were found between Pearson's and HumRRO's parameter estimation, Stocking-Lord transformation constants, or raw-score-to-scale-score tables. Given that HumRRO's and Pearson's scaling and equating results were identical, HumRRO is confident that Pearson did not commit processing errors.

References

Bynum, B. H., & Thacker, A. A. (2011). *Third-party checking of calibration scaling and equating of the 2011 Kentucky core content test* (FR-11-65). Alexandria, VA: Human Resources Research Organization.

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Huynh, H. (2000, June). *Guidelines for Rasch Linking for PACT.* Memorandum to Paul Sandifer on June 18, 2000. Columbia, SC: Available from Author.

Huynh, H., & Meyer, P. (2010). Use of robust z in detecting unstable items in item response theory models. *Practical Assessment, Research & Evaluation*, 15(2). Available online: http://pareonline.net/getvn.asp?v=15&n=2.

Huynh, H., & Rawls, A. (2009). A comparison between robust z and 0.3-logit difference procedures in assessing stability of linking items for the Rasch model. In Everett V. Smith Jr. & Greg E. Stone (Eds.) *Applications of Rasch Measurement in Criterion-Referenced Testing: Practice Analysis to Score Reporting.* Maple Grove, MN: JAM Press.

Thacker, A. A., Dickinson, E. R., & Sinclair, A. L. (2013). *Policy capture for setting end-of-course and Kentucky Performance Rating for Education Progress (K-PREP) cut scores* (2013 No. 007). Alexandria, VA: Human Resources Research Organization.

Pearson (2012). *Kentucky performance rating for educational progress performance standards workshop: Performance level descriptor creation and standard setting, v1.1.* Pearson, Inc.

Appendix A – Control File (Reading Grade 3)

```
;Winstep Control file c03RD_v0
; HumRRO
&INST
Item1 = 25
NI = 38
TABLES = 00100000000001000001000000001
CODES = 012
CSV = N
FITP = 3.0
FITI = 3.0
XWIDE =1
HLINES = Y
data=c03RDmopv0.dat
IFILE= c03RDv0.ITM
ISFILE = c03RDv0.ISF
SFILE =  c03RDv0.CSF
;IAFILE = c03RDv0.IAF
;SAFILE = c03RDv0.SAF
SCFILE = c03RDv0.RSS
PFILE = c03RDv0.PER
mprox=10
mucon=100
rconv=.50
lconv=.01
models=r
groups=0
stkeep=n
realse=n
stbias=n
target=n
extrsc=0.25
udecim=4
uimean=0
uscale=1
;upmean=0
;uanchor=y
ptbis=y
ILFILES = *
2104907
2104912
2104918
2104925
2104930
2104939
2104940
2104941
2104950
2104953
2104955
```

```
2104959
201835
201829
201832
201839
201833
R3262
R3253
R3254
R3258
R3257
R3261
R3255
R3263
201715
201652
201724
201661
201659
201655
R3180
R3173
R3176
R3178
R3183
R3179
R3175
*
  &END
END NAMES
```

```
; ITEM STRUCTURE FILE (not for anchoring: use SFILE=) FOR C:\Data\Kentucky\KPREP2014\WINSTEP\c03RDv0_eq.con Jul  9 12:47 2014
;ENTRY STAT  MAX  CAT BOT+.25  CAT STRU MEASURE    ERROR CAT-0.5   AT CAT  50%PRB  CAT STRU MEASURE    ERROR CAT-0.5 TOP-.25  50%PRB
      1   1    1    0 -2.1024    1    1 -1.0038    .0123 -1.0038    .0949 -1.0038    0    0   .0000    .0000   .0000   .0000   .0000
      2   1    1    0 -2.6991    1    1 -1.6005    .0144 -1.6005   -.5019 -1.6005    0    0   .0000    .0000   .0000   .0000   .0000
      3   2    1    0 -1.4863    1    1  -.3877    .0110  -.3877    .7109  -.3877    0    0   .0000    .0000   .0000   .0000   .0000
      4   2    1    0  -.4253    1    1   .6733    .0101   .6733   1.7719   .6733    0    0   .0000    .0000   .0000   .0000   .0000
      5   1    1    0 -1.5722    1    1  -.4736    .0111  -.4736    .6250  -.4736    0    0   .0000    .0000   .0000   .0000   .0000
      6   1    1    0 -3.2669    1    1 -2.1683    .0173 -2.1683  -1.0697 -2.1683    0    0   .0000    .0000   .0000   .0000   .0000
      7   1    1    0 -2.5375    1    1 -1.4389    .0137 -1.4389   -.3403 -1.4389    0    0   .0000    .0000   .0000   .0000   .0000
      8   1    1    0 -2.7294    1    1 -1.6308    .0145 -1.6308   -.5322 -1.6308    0    0   .0000    .0000   .0000   .0000   .0000
      9   2    1    0  -.9508    1    1   .1478    .0103   .1478   1.2464   .1478    0    0   .0000    .0000   .0000   .0000   .0000
     10   1    1    0   .3093    1    1  1.4079    .0104  1.4079   2.5065  1.4079    0    0   .0000    .0000   .0000   .0000   .0000
     11   1    1    0 -1.6362    1    1  -.5376    .0112  -.5376    .5610  -.5376    0    0   .0000    .0000   .0000   .0000   .0000
     12   2    1    0  -.9574    1    1   .1412    .0103   .1412   1.2398   .1412    0    0   .0000    .0000   .0000   .0000   .0000
     13   1    1    0 -2.2710    1    1 -1.1723    .0128 -1.1723   -.0737 -1.1723    0    0   .0000    .0000   .0000   .0000   .0000
     14   1    1    0  -.4831    1    1   .6155    .0101   .6155   1.7141   .6155    0    0   .0000    .0000   .0000   .0000   .0000
     15   1    1    0 -2.3353    1    1 -1.2367    .0130 -1.2367   -.1381 -1.2367    0    0   .0000    .0000   .0000   .0000   .0000
     16   2    1    0  -.8046    1    1   .2940    .0102   .2940   1.3926   .2940    0    0   .0000    .0000   .0000   .0000   .0000
     17   2    1    0  -.7339    1    1   .3647    .0102   .3647   1.4633   .3647    0    0   .0000    .0000   .0000   .0000   .0000
     18   2    1    0  -.8624    1    1   .2362    .0102   .2362   1.3348   .2362    0    0   .0000    .0000   .0000   .0000   .0000
     19   2    1    0 -1.7580    1    1  -.6594    .0115  -.6594    .4392  -.6594    0    0   .0000    .0000   .0000   .0000   .0000
     20   1    1    0 -2.1067    1    1 -1.0081    .0123 -1.0081    .0905 -1.0081    0    0   .0000    .0000   .0000   .0000   .0000
     21   1    1    0   .2637    1    1  1.3623    .0103  1.3623   2.4609  1.3623    0    0   .0000    .0000   .0000   .0000   .0000
     22   2    1    0  -.5875    1    1   .5111    .0101   .5111   1.6097   .5111    0    0   .0000    .0000   .0000   .0000   .0000
     23   2    1    0  -.3134    1    1   .7852    .0101   .7852   1.8838   .7852    0    0   .0000    .0000   .0000   .0000   .0000
     24   2    1    0 -1.2452    1    1  -.1466    .0106  -.1466    .9520  -.1466    0    0   .0000    .0000   .0000   .0000   .0000
     25   1    2    0 -1.7308    1    1  -.5389    .0123  -.8125    .4516  -.6545    2    2  1.4420    .0110  1.7156  2.6339  1.5576
     26   1    1    0 -1.9989    1    1  -.9003    .0120  -.9003    .1983  -.9003    0    0   .0000    .0000   .0000   .0000   .0000
     27   1    1    0 -1.7388    1    1  -.6402    .0114  -.6402    .4584  -.6402    0    0   .0000    .0000   .0000   .0000   .0000
     28   1    1    0 -1.6611    1    1  -.5624    .0113  -.5624    .5362  -.5624    0    0   .0000    .0000   .0000   .0000   .0000
     29   1    1    0 -1.2625    1    1  -.1639    .0106  -.1639    .9347  -.1639    0    0   .0000    .0000   .0000   .0000   .0000
     30   1    1    0 -1.4935    1    1  -.3949    .0110  -.3949    .7037  -.3949    0    0   .0000    .0000   .0000   .0000   .0000
     31   1    1    0 -1.9038    1    1  -.8052    .0118  -.8052    .2935  -.8052    0    0   .0000    .0000   .0000   .0000   .0000
     32   1    1    0   .5500    1    1  1.6486    .0107  1.6486   2.7472  1.6486    0    0   .0000    .0000   .0000   .0000   .0000
     33   2    1    0 -1.2795    1    1  -.1809    .0107  -.1809    .9177  -.1809    0    0   .0000    .0000   .0000   .0000   .0000
     34   1    1    0   .7460    1    1  1.8446    .0109  1.8446   2.9432  1.8446    0    0   .0000    .0000   .0000   .0000   .0000
     35   1    1    0  -.9417    1    1   .1569    .0103   .1569   1.2555   .1569    0    0   .0000    .0000   .0000   .0000   .0000
     36   2    1    0 -1.6133    1    1  -.5147    .0112  -.5147    .5839  -.5147    0    0   .0000    .0000   .0000   .0000   .0000
     37   2    1    0 -1.1554    1    1  -.0568    .0105  -.0568   1.0418  -.0568    0    0   .0000    .0000   .0000   .0000   .0000
     38   1    2    0 -1.2112    1    1   .3307    .0121  -.5438    .2753  -.1814    2    2   .2200    .0108  1.0944  1.7618   .7322
```

Step Parameters

```
; STRUCTURE MEASURE ANCHOR FILE FOR
C:\Data\Kentucky\KPREP2014\WINSTEP\c03RDv0_eq.con Jul  9 12:47 2014
; ITEM CATEGORY  Rasch-Andrich threshold MEASURE
     1   0    .0000
     1   1    .0000
     2   0    .0000
     2   1    .0000
     3   0    .0000
     3   1    .0000
     4   0    .0000
     4   1    .0000
     5   0    .0000
     5   1    .0000
     6   0    .0000
     6   1    .0000
     7   0    .0000
     7   1    .0000
     8   0    .0000
     8   1    .0000
     9   0    .0000
     9   1    .0000
    10   0    .0000
    10   1    .0000
    11   0    .0000
    11   1    .0000
    12   0    .0000
    12   1    .0000
    13   0    .0000
    13   1    .0000
    14   0    .0000
    14   1    .0000
    15   0    .0000
    15   1    .0000
    16   0    .0000
    16   1    .0000
    17   0    .0000
    17   1    .0000
    18   0    .0000
    18   1    .0000
    19   0    .0000
    19   1    .0000
    20   0    .0000
    20   1    .0000
    21   0    .0000
```

```
21  1    .0000
22  0    .0000
22  1    .0000
23  0    .0000
23  1    .0000
24  0    .0000
24  1    .0000
25  0    .0000
25  1  - .9905
25  2    .9905
26  0    .0000
26  1    .0000
27  0    .0000
27  1    .0000
28  0    .0000
28  1    .0000
29  0    .0000
29  1    .0000
30  0    .0000
30  1    .0000
31  0    .0000
31  1    .0000
32  0    .0000
32  1    .0000
33  0    .0000
33  1    .0000
34  0    .0000
34  1    .0000
35  0    .0000
35  1    .0000
36  0    .0000
36  1    .0000
37  0    .0000
37  1    .0000
38  0    .0000
38  1    .0553
38  2  - .0553
```

Appendix C – Robust Z Item Stability Analysis

Step 1. Calculate the mean and standard deviation of the previous item parameter estimates of the linking items: b-parameter for multiple-choice items and step parameter estimates for open-ended items.

Step 2. Calculate the mean and standard deviation of the 2014 item parameter estimates of the linking items: b-parameter for multiple-choice items and step parameter estimates for open-ended items.

Step 3. Calculate the ratio of standard deviations.

Step 4. Calculate the correlation between the 2014 and previous item parameter estimates of the linking items.

Step 5. Calculate the difference between the 2014 and previous item parameter estimates for each linking item (e.g., b_{old}-b_{2014} for multiple-choice item; $d_{1,old}$-$d_{1,2014}$ for open-ended item).

Step 6. Calculate the median and interquartile range of the differences calculated in Step 5.

Step 7. Calculate the robust z statistic for each linking item using the following equation:

$$Z = \frac{D - M_d}{0.74 * IQR},$$

where D is the difference in item parameter estimates, M_d, is the median of the differences, and *IQR* is the interquartile range of the differences (SAS default: Definition 5).

Once all robust z statistics have been calculated for a linking set, the following guidelines dictate removing linking items from equating:

a. The ratio of standard deviations must be in the 0.9-1.1 range; the correlation of item parameter estimates must be greater then 0.95.

b. If either condition in (a) is not met, then remove the linking item with the largest absolute robust z value (assuming it is greater than 1.645). *Note: If one step difficulty of the open-ended item is removed then all other step difficulties for that open-ended item are removed as well.*

c. Repeat steps 1 through 4 – do not recalculate robust z statistics – and continue removing linking items until:

- the standard deviation ratio and correlation of item difficulties are within the prescribed range; or
- there are no linking items with an absolute robust z value greater than 1.645; or
- 20% of the linking item set has been removed.[3]

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[3] This will be discussed if the number of flagged items for removal exceeds the criterion.

Appendix D – Winsteps Anchor File (Grade 3 Reading)

Multiple Choice Item Anchor File

ENTRY	MEASURE	ST	COUNT	SCORE	ERROR	IN.MSQ	IN.ZST	OUT.MS	OUT.ZS	DISPL	PTBISE	WEIGHT	OBSMA	EXPMA	DISCRM	LOWER	UPPER	PVALU	PBE-E			RMSR
17	.3647	1	50135.0	29662.0	.0102	1.10	9.90	1.14	9.90	-.0001	.32	1.00	66.8	70.5	.76	.08	.96	.59	.40	.46 0 R	.	201833
16	.2940	1	50135.0	28419.0	.0101	1.05	9.90	1.06	9.36	-.0001	.36	1.00	68.0	70.0	.88	.07	.99	.57	.40	.45 0 R	.	201839
3	-.3877	1	50135.0	36363.0	.0111	1.05	9.71	1.08	7.90	-.0003	.34	1.00	74.7	76.3	.91	.06	.98	.73	.38	.41 0 R	.	2104918
4	.6733	1	50135.0	25599.0	.0101	.98	-5.80	.98	-3.64	-.0002	.42	1.00	70.5	69.3	1.06	.00	1.00	.51	.40	.44 0 R	.	2104925
9	.1478	1	50135.0	30918.0	.0103	1.05	9.90	1.07	8.92	-.0003	.35	1.00	68.9	71.3	.88	.08	.99	.62	.40	.45 0 R	.	2104950
12	.1412	1	50135.0	30678.0	.0103	.97	-6.53	.96	-5.19	-.0003	.43	1.00	72.1	71.1	1.07	.00	1.00	.61	.40	.43 0 R	.	2104959
33	-.1809	1	50135.0	35132.0	.0109	.96	-8.94	.96	-4.78	-.0006	.43	1.00	76.7	74.9	1.08	.00	1.00	.70	.39	.40 0 R	.	R3173
37	-.0568	1	50135.0	31370.0	.0104	1.07	9.90	1.19	9.90	-.0002	.34	1.00	70.4	71.5	.80	.00	.95	.63	.40	.45 0 R	.	R3179
36	-.5147	1	50135.0	36027.0	.0110	1.03	5.94	1.15	9.90	-.0006	.35	1.00	76.2	75.9	.92	.00	.98	.72	.39	.41 0 R	.	R3183
19	-.6594	1	50135.0	36921.0	.0112	1.02	2.89	1.04	3.86	-.0005	.37	1.00	76.9	77.0	.97	.00	.99	.74	.38	.40 0 R	.	R3253
24	-.1466	1	50135.0	33680.0	.0106	1.02	4.82	1.02	1.81	-.0006	.38	1.00	72.5	73.4	.96	.05	1.00	.67	.40	.43 0 R	.	R3255
22	.5111	1	50135.0	29982.0	.0102	.94	-9.90	.91	-9.90	-.0005	.46	1.00	73.4	70.7	1.15	.00	1.00	.60	.40	.42 0 R	.	R3257
23	.7852	1	50135.0	24946.0	.0101	1.05	9.90	1.07	9.90	.0002	.35	1.00	67.7	69.3	.87	.06	1.00	.50	.40	.45 0 R	.	R3261
18	.2362	1	50135.0	29102.0	.0102	1.00	.24	1.00	.19	-.0002	.40	1.00	70.1	70.3	1.00	.04	1.00	.58	.40	.44 0 R	.	R3262

Step Parameter Anchor File (Grade 8 Mathematics)

; ITEM CATEGORY Rasch-Andrich threshold MEASURE

```
     6  0  0.0000
     6  1  0.0000
     8  0  0.0000
     8  1  0.0000
    10  0  0.0000
    10  1  0.0000
    11  0  0.0000
    11  1  0.0000
    14  0  0.0000
    14  1  0.0000
    16  0  0.0000
    16  1  0.0000
    17  0  0.0000
    17  1  0.0000
    18  0  0.0000
    18  1  0.0000
    19  0  0.0000
    19  1  0.0000
    26  0  0.0000
```

26	1	0.0000
27	0	0.0000
27	1	0.0000
28	0	0.0000
28	1	0.0000
29	0	0.0000
29	1	0.0000
33	0	0.0000
33	1	0.0000
35	0	0.0000
35	1	0.0000
36	0	0.0000
36	1	-0.8860
36	2	0.8861
37	0	0.0000
37	1	-1.4108
37	2	1.4108
41	0	0.0000
41	1	0.0000
42	0	0.0000
42	1	0.0000
43	0	0.0000
43	1	0.0000
44	0	0.0000
44	1	0.0000
46	0	0.0000
46	1	0.0000

```
PERSON SCORE FILE FOR C:\Data\Kentucky\KPREP2014\WINSTEP\c03RDv0_eq.con Jul  9 12:47 2014
USCALE=1.00
```

SCORE	MEASURE	S.E.	INFO	NORMED	S.E.	FREQUENCY	%	CUM.FREQ.	%	PERCENTILE
0	-5.5964	2.0122	.25	-26	167	121	.2	121	.2	1
1	-4.1734	1.0241	.95	92	85	3	.0	124	.2	1
2	-3.4315	.7408	1.82	153	61	3	.0	127	.3	1
3	-2.9772	.6182	2.62	191	51	9	.0	136	.3	1
4	-2.6406	.5468	3.34	219	45	20	.0	156	.3	1
5	-2.3684	.4992	4.01	242	41	55	.1	211	.4	1
6	-2.1367	.4650	4.62	261	39	113	.2	324	.6	1
7	-1.9327	.4392	5.18	278	36	187	.4	511	1.0	1
8	-1.7488	.4190	5.69	293	35	277	.6	788	1.6	1
9	-1.5801	.4029	6.16	307	33	377	.8	1165	2.3	2
10	-1.4232	.3898	6.58	320	32	514	1.0	1679	3.3	3
11	-1.2755	.3791	6.96	332	31	562	1.1	2241	4.5	4
12	-1.1352	.3702	7.29	344	31	722	1.4	2963	5.9	5
13	-1.0009	.3629	7.59	355	30	732	1.5	3695	7.4	7
14	-.8714	.3569	7.85	366	30	876	1.7	4571	9.1	8
15	-.7458	.3520	8.07	376	29	925	1.8	5496	11.0	10
16	-.6233	.3481	8.25	386	29	1059	2.1	6555	13.1	12
17	-.5033	.3451	8.40	396	29	1106	2.2	7661	15.3	14
18	-.3849	.3430	8.50	406	28	1231	2.5	8892	17.7	17
19	-.2678	.3416	8.57	416	28	1338	2.7	10230	20.4	19
20	-.1513	.3411	8.60	426	28	1465	2.9	11695	23.3	22
21	-.0350	.3413	8.58	435	28	1657	3.3	13352	26.6	25
22	.0818	.3424	8.53	445	28	1757	3.5	15109	30.1	28
23	.1997	.3443	8.43	455	29	1769	3.5	16878	33.7	32
24	.3192	.3472	8.30	465	29	1875	3.7	18753	37.4	36

25	.4410	.3510	8.12	475	29	2004	4.0	20757	41.4	39
26	.5658	.3559	7.89	485	30	2228	4.4	22985	45.8	44
27	.6946	.3620	7.63	496	30	2365	4.7	25350	50.6	48
28	.8284	.3696	7.32	507	31	2348	4.7	27698	55.2	53
29	.9683	.3788	6.97	518	31	2473	4.9	30171	60.2	58
30	1.1159	.3899	6.58	531	32	2535	5.1	32706	65.2	63
31	1.2731	.4035	6.14	544	33	2572	5.1	35278	70.4	68
32	1.4425	.4201	5.67	558	35	2528	5.0	37806	75.4	73
33	1.6275	.4408	5.15	573	37	2600	5.2	40406	80.6	78
34	1.8332	.4671	4.58	590	39	2397	4.8	42803	85.4	83
35	2.0671	.5017	3.97	610	42	2201	4.4	45004	89.8	88
36	2.3422	.5496	3.31	633	46	1891	3.8	46895	93.5	92
37	2.6820	.6210	2.59	661	52	1483	3.0	48378	96.5	95
38	3.1401	.7435	1.81	699	62	1058	2.1	49436	98.6	98
39	3.8861	1.0262	.95	761	85	529	1.1	49965	99.7	99
40	5.3124	2.0133	.25	879	167	170	.3	50135	100.0	99

Appendix F – Comparison of Files Output (Reading Grade 3)

```
aO3RDvO_eq ITEM Parameter comparison
                 theta_                                              theta_
 Obs   rs     theta      hum        se     SE_Hum    ss   SS_hum  PL  PL_hum    diff    SS_diff  PL_diff

  1     0    -5.5964   -5.5964   2.0122   2.0122   105    105     N    N       0.0000      0        0
  2     1    -4.1734   -4.1734   1.0241   1.0241   129    129     N    N       0.0000      0        0
  3     2    -3.4314   -3.4315   0.7408   0.7408   141    141     N    N       0.0001      0        0
  4     3    -2.9772   -2.9772   0.6182   0.6182   149    149     N    N       0.0000      0        0
  5     4    -2.6406   -2.6406   0.5468   0.5468   154    154     N    N       0.0000      0        0
  6     5    -2.3684   -2.3684   0.4992   0.4992   159    159     N    N       0.0000      0        0
  7     6    -2.1366   -2.1367   0.4650   0.4650   163    163     N    N       0.0001      0        0
  8     7    -1.9327   -1.9327   0.4392   0.4392   166    166     N    N       0.0000      0        0
  9     8    -1.7488   -1.7488   0.4190   0.4190   169    169     N    N       0.0000      0        0
 10     9    -1.5801   -1.5801   0.4029   0.4029   172    172     N    N       0.0000      0        0
 11    10    -1.4232   -1.4232   0.3898   0.3898   175    175     N    N       0.0000      0        0
 12    11    -1.2755   -1.2755   0.3791   0.3791   177    177     N    N       0.0000      0        0
 13    12    -1.1352   -1.1352   0.3702   0.3702   180    180     N    N       0.0000      0        0
 14    13    -1.0009   -1.0009   0.3629   0.3629   182    182     N    N       0.0000      0        0
 15    14    -0.8714   -0.8714   0.3569   0.3569   184    184     N    N       0.0000      0        0
 16    15    -0.7458   -0.7458   0.3520   0.3520   186    186     N    N       0.0000      0        0
 17    16    -0.6233   -0.6233   0.3481   0.3481   188    188     N    N       0.0000      0        0
 18    17    -0.5033   -0.5033   0.3451   0.3451   190    190     N    N       0.0000      0        0
 19    18    -0.3849   -0.3849   0.3430   0.3430   192    192     N    N       0.0000      0        0
 20    19    -0.2678   -0.2678   0.3416   0.3416   194    194     N    N       0.0000      0        0
 21    20    -0.1513   -0.1513   0.3411   0.3411   196    196     N    N       0.0000      0        0
 22    21    -0.0350   -0.0350   0.3413   0.3413   198    198     A    A       0.0000      0        0
 23    22     0.0819    0.0818   0.3424   0.3424   200    200     A    A       0.0001      0        0
 24    23     0.1997    0.1997   0.3443   0.3443   202    202     A    A       0.0000      0        0
 25    24     0.3192    0.3192   0.3472   0.3472   204    204     A    A       0.0000      0        0
 26    25     0.4410    0.4410   0.3510   0.3510   206    206     A    A       0.0000      0        0
 27    26     0.5658    0.5658   0.3559   0.3559   208    208     A    A       0.0000      0        0
 28    27     0.6946    0.6946   0.3620   0.3620   210    210     P    P       0.0000      0        0
 29    28     0.8284    0.8284   0.3696   0.3696   212    212     P    P       0.0000      0        0
 30    29     0.9683    0.9683   0.3788   0.3788   215    215     P    P       0.0000      0        0
 31    30     1.1159    1.1159   0.3899   0.3899   217    217     P    P       0.0000      0        0
 32    31     1.2731    1.2731   0.4035   0.4035   220    220     P    P       0.0000      0        0
 33    32     1.4425    1.4425   0.4201   0.4201   223    223     P    P       0.0000      0        0
```

34	33	1.6275	1.6275	0.4408	0.4408	226	226	D	D	0.0000	0	0
35	34	1.8332	1.8332	0.4671	0.4671	229	229	D	D	0.0000	0	0
36	35	2.0671	2.0671	0.5017	0.5017	233	233	D	D	0.0000	0	0
37	36	2.3422	2.3422	0.5496	0.5496	238	238	D	D	0.0000	0	0
38	37	2.6820	2.6820	0.6210	0.6210	243	243	D	D	0.0000	0	0
39	38	3.1400	3.1401	0.7435	0.7435	251	251	D	D	-.0001	0	0
40	39	3.8861	3.8861	1.0262	1.0262	263	263	D	D	0.0000	0	0
41	40	5.3124	5.3124	2.0133	2.0133	287	287	D	D	0.0000	0	0